ORIGINAL ARTICLE

Coarctation of Aorta Repair at the National Heart Institute (1983-1994)

S M S J Adeeb, M Surg*, H Leman, M Surg, A Sallehuddin, FRCS**, A Yakub, FRCS**, Y Awang, FRCS**, M Alwi, MRCP*****

*Division of Cardiothoracic Surgery, Department of Surgery, Hospital Universiti Kebangsaan Malaysia, Kuala Lumpur, **Department of Cardiothoracic Surgery, ***Department of Cardiology, Institut Jantung Negara (National Heart Institute), Kuala Lumpur

Summary

This retrospective study illustrates our approach to this problem over the years, from performing subclavian flap aortoplasty initially to the more accepted procedure now, which is resection and end-to-end anastomosis. Coarctation of aorta in our population is seen in a varying age groups and are also associated with other cardiac anomalies including both acyanotic and cyanotic congenital cardiac defects. Therefore a wide variety of surgical procedures were performed including resection of the coarcted segment and end-to-end anastomosis, subclavian flap aortoplasty, patch aortoplasty and synthetic tube graft interposition. Subclavian flap aortoplasty is not widely practised anymore in favour of resection with end-to-end anastomosis. Fifty four point four percent of patients had isolated coarctation, 10.5% had associated valvular defects, 28.1% had other simple congenital defects and 7.0% had associated complex cyanotic congenital defects. Perioperative mortality was 5.26% and is correlated with the younger age of patients at time of surgery and severity of cardiac failure at time of presentation. We did not see any difference in mortality for patients with complex congenital disease or between the different surgical procedures. However, we did find that in the early period when resection with end-to-end anastomosis was performed, there was a significantly higher incidence of morbidities.

Key Words: Aortic Coarctation

Introduction

Coarctation of the aorta is related to a higher morbidity and mortality in neonates who present in cardiac failure[1]. Previous reports showed that both morbidity and mortality were higher with increasing complexity of associated anomalies[2,3,4,5]. We have tried to select the right form of surgical strategy for the varying patient types in terms of age at presentation, severity of cardiac failure and presence of complex anomalies. We studied the practice of repair in our center in order to attempt to analyze the suitability of our strategies and to look at the results of repair, associated morbidity and mortality, and also to study the possible risk factors which may influence recoarctation after repair.

Materials and Methods

This is a retrospective study of 120 consecutive patients who had repair of coarctation of the aorta. This includes simultaneous intracardiac repairs from March 1983 till December 1994. Questionnaires regarding the current status, presence of recoarctation and presence of hypertension were sent out to all major hospitals conducting follow up with 100% compliance to questionnaires from participating hospitals. All 114 surviving patients were well on follow-up. All patients had a repeat 2D Echocardiogram within a week of surgery and a later 2D Echocardiogram when there were signs and symptoms. Recoarctation was diagnosed

This article was accepted: 20 May 2003
Corresponding Author: Syed Mohd Adeeb, Department of Surgery, Hospital University Kebangsaan Malaysia, Jalan Yaacob Latiff, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur

clinically when patients had reemergence of symptoms of cardiac failure or when follow up 2D echocardiogram studies were performed. The perioperative pressure gradients were not documented in some patients. Statistical analysis was performed on parametric categorical data via Chi-square test and Student's t-distribution test.

Results

The follow up period ranged from 72 months to 150 months with a mean of 96 months.

Surgical repair was achieved in 114 of patients, 1 patient died before surgery from cardiac failure, 3 patients did not require repair as the coarctation was mild, 1 patient underwent primary balloon dilatation and 1 patient improved after release of a congenital band over the descending aorta.

The associated anomalies that were seen included 62 pts (54.4%) with isolated coarctation, 32 pts (28.1%) with either atrial or ventricular septal defects, 12 patients (10.5%) with valvular defects (bicuspid aortic valves, aortic regurgitation, aortic stenosis, mitral stenosis, mitral regurgitation), 8 patients (7.0%) with complex cyanotic congenital heart disease (transposition of great arteries, double outlet right ventricle, Tetralogy of Fallot).

Surgical procedures performed included resection and end-to-end anastomosis (RETE n = 54), subclavian flap aortoplasty (SFA n = 38), dacron patch aortoplasty (DPA n = 15) and tube graft interposition (TGI n = 5). We noted 6 cases with recoarctation and this was not affected by the types of surgery performed. However, recoarctation was significantly higher in neonates ($p<0.05$).

Table I: Age at which surgery was performed, presence of cardiac failure and mortality.

Age of patient	Number of patient	Cardiac Failure	Mortality
0-29 days	14	8 (Severe)	4
1-11 months	42	42 (Medically controlled)	2
1-4 years	33	0	0
5-9 years	12	0	0
10-19 years	9	0	0
20-29 years	3	0	0
30-39 years	1	0	0
Total	**114**	**50**	**6**

Table II: Age at surgery, types of procedures and recoarctation.

Age	Number of patients with recoarctation	Procedure
0-29 days	2 of 14	RETE n=1 SFA n=1
1-11 months	3 of 42	RETE n=1 SFA n=2
12-48 months	1 of 16	DPA n=1
Total	**6 of 72**	

Table III: Associated morbidities with surgical procedures performed

Morbidities	Types of Surgery	Number of patients
Persistent Hypertension	RETE n=7 SFA n=17 DPA n=2 TGI n=5	31
Arrhythmias	RETE n=3 SFA n=2	5
Respiratory Failure	RETE n=4 SFA n=3 DPA n=1	8
Myocardial Failure	SFA n=2 DPA n=1	3
Bronchopneumonia	RETE n=5 SFA n=3 DPA n=1	9
Bleeding	RETE n=3	3
Chylothorax	RETE n=1	1
Recurrent Laryngeal Nerve Injury	RETE n=1	1
Neurological Deficit	RETE n=4	4

There was a significant difference in morbidities in general between resection with end-to-end anastomosis versus the other three procedures ($p<0.01$).

There were 6 mortalities in our series and these were from postoperative infections and persistent left ventricular failure consisting of 4 patients in the neonatal age and 2 patients between the ages of 1 and 11 months. Both age and severity of cardiac failure were significant predictors of mortality ($p<0.01$). None of these patients had recoarctation as the mortalities occurred in the early postoperative period.

Discussion

This is our initial experience with coarctation of aorta. Over the years the preferred procedure has become extended resection and end-to-end anastomosis. This has been reported to be the procedure with the lowest recoarctation rate in neonates as the ductal tissue is completely excised, tubular hypoplasia of the aortic arch is relieved and use of autologous tissue allows for growth[6]. However, for older patients where mobilisation and apposition is more difficult, interposition synthetic tube grafts are more suitable. It was noted that resection with end-to-end anastomosis had a significantly higher rate of morbidity and this was related to the procedure being performed in neonates and smaller children. The main reason for this phenomena would be the discontinuation of other procedures in favour of resection with end-to-end anastomosis thus not allowing for more numbers to be studied in the procedures discontinued. The early learning curve may also be a factor.

We were concerned with the risk of recoarctation and risk factors contributing to mortality. As shown, there was no difference in the rate of recoarctation between the 3 types of procedures with a mean follow up period of 96 months. Our method of resection and end-to-end anastomosis is the extended type which was originally described by Amato[7] where a part of the inominate artery is clamped and the incision extended to involve the inominate artery, the so called radically extended end-to-end anastomosis. We found that this procedure requires a more extensive mobilization and would not be suitable for older patients with bigger anatomy. When dissection and mobilization was difficult, a tube graft interposition or a patch aortoplasty was done to repair the coarctation segment. This was especially seen

in patients more than 10 years of age. We do not perform subclavian flap angioplasty and patch aortoplasty anymore due to a concern for limb shortening and a higher incidence of recoarctation[6].

Recoarctation occurred in 6 patients with 3 patients requiring balloon dilatation. None of our patients required further surgical intervention. We could not find any difference in recoarctation rates between the subclavian flap repair versus the resection and end-to-end anastomosis perhaps as a result of our initial techniques. A high recoarctation rate is still possible in patients undergoing resection and end-to-end anastomosis if the problems of arch hypoplasia and inadequate resection are not addressed[8].

The only perioperative risk factors contributing to mortality were younger age of patients and severity of cardiac failure. Associated complex anomalies were not a significant contributor to mortality. Limitations of this study includes a lower recoarctation rate due to the surveillance method of performing echocardiography in symptomatic patients only, technique variability depending on surgeon's preference and limited number of patients in the group of patients with associated complex cardiac anomalies.

Thus we would recommend performing extended resection and end-to-end anastomosis in patients with coarctation of aorta in infancy and early childhood as we have gained experience in this procedure with good outcome in terms of morbidity and mortality.

References

1. Conte S., Lacour-Gayet F., Serraf A., Sousa-Uva M., Bruniaux J., Touchot A., Planche C. Surgical Management of Neonatal Coarctation. J Thorac Cardiovasc Surg 1995; 109: 663-75.
2. Zehr K.J., Gillinov A.M., Redmond J.M., Greene P.S., Kan J.S., Gardner T.J., Reitz B.A., Cameron D.E. Repair of Coarctation of the Aorta in Neonates and Infants: A Thirty Year Experience. Ann Thorac Surg. 1995; 59: 33-41.
3. Kappetein A.P., Zwinderman A.H., Bogers A.J.J.C., Rohmer J., Huysmans H.A. More than thirty five years of Coarctation Repair. J Thorac Cardiovasc Surg. 1994; 107: 87-95.
4. Sciolaro C., Copeland J., Cork R., Barkenbush M., Donnerstein R., Goldberg S. LongTerm Follow Up Comparing Subclavian Flap Angioplasty to Resection with Modified Oblique End-To-End Anastomosis. J Thorac Cardiovasc Surg. 1991; 101: 1-13.
5. van Huern L.W.E., Wong C.M., Spiegelhalter D.J., Sorensen K., de Leval M.R. Stark J., Elliot M.J. Surgical Treatment of Aortic Coarctation in Infants Younger than 3 months : 1985-1990. J Thorac Cardiovasc Surg. 1994; 107: 74-86.
6. Backer C.L., Mavroudis C., Zias E.A., Amin Z., Weigel T.J. Repair of Coarctation with Resection and Extended End-To-End Anastomosis. Ann Thorac Surg. 1998; 66: 1365-71.
7. Amato J.J., Rheinlander H.F., Cleveland R.J., A Method of Enlarging the Distal Transverse Arch in Infants with Hypoplasia and Coarctation of the Aorta. Ann Thorac Surg. 1977; 23: 261-3.
8. Suzuki T., Fukuda T., Ito T. Modified End-To-End Anastomosis Combined with Subclavian Flap Aortoplasty for Repair of Coarctation of Aorta with Extended Hypoplasia of the Aortic Isthmus. J Card Surg. 1999; 14: 359-62.